A number of minor corrections follow:
Page 24, line 8, change "order" to "degree."
Page 30, last line, numerator of first integral, change ∂ to δ.
Page 38, next to last line, change ∂ to δ.

WALTER B. FORD.

UNIVERSITY OF MICHIGAN,
August, 1917.

PROBLEMS FOR SOLUTION.

SEND ALL COMMUNICATIONS ABOUT PROBLEMS TO B. F. FINKEL, Springfield, Mo.

ALGEBRA.

492. Proposed by ARTEMUS MARTIN, LL.D., Washington, D. C.

If two numbers, A and B, $B > A$, be selected at random, what is the probability that they have no common divisor?

493. Proposed by ALBERT BABBITT, University of Nebraska.

Determine the coefficients b, c, d of the equation $x^3 + bx^2 + cx + d = 0$ so that they should be roots of the same equation. [From *Supplemento a Periodico di Matematica.*]

494. Proposed by N. P. PANDYA, Sojitra, India.

Solve algebraically and also graphically, $\log \sin x = \sin \log x$.

GEOMETRY.

524. Proposed by NORMAN ANNING, Somewhere in France.

Many railways use as "easement curve" the cubic parabola. If points on such a curve are named by their distances measured along the curve from the point of inflection ("flat end") show that, within the limits of ordinary practice, *i. e.*, for angles so small that the difference between arc and sine is inappreciable, the deflection from tangent at m to set n is $(n - m)(n + 2m)$ times the deflection from tangent at 0 to 1.

525. Proposed by C. N. SCHMALL, New York City.

Given a quadrant of a circle AOB, where OA and OB are bounding radii, and a semicircle ACO having OA as a diameter and lying on the same side as the quadrant. Describe a circle which shall touch the two arcs and the radius OB.

CALCULUS.

440. Proposed by JOSEPH B. REYNOLDS, Lehigh University.

If t is the differential vector joining two consecutive points on a space curve and R is the radius of curvature of the curve at that point, prove that

$$R^2 = \frac{(t \cdot t)^3}{(t \times \dot{t}) \cdot (t \times \dot{t})}.$$

441. Proposed by J. L. RILEY, Stephenville, Texas.

Find the minimum value of

$$\int \left\{ \left(\frac{dy}{dx}\right)^2 \sin x + (y + x - \sin x)^2 / \sin x \right\} dx.$$

MECHANICS.

356. Proposed by FLORENCE P. LEWIS, Goucher College, Baltimore.

A ray of light enters a prism having vertex angle α. If the angle between the incoming and the outgoing directions is defined as the angle of deviation, at what angle must the ray enter the prism in order that the angle of deviation may be a minimum?

357. Proposed by JOSEPH B. REYNOLDS, Lehigh University.

Two beads each of mass m connected by a string of length $2l$ and carrying a mass m' at its middle point are threaded symmetrically with respect to the major axis which is vertical on a

smooth ellipse of eccentricity e and latus rectum $2l$. The string is held taut and horizontal, then released; find the velocities of the beads when the end ones impinge.

NUMBER THEORY.

274. Proposed by J. L. RILEY, Stephenville, Texas.

Solve in positive integers the equation

$$x^4 + x^3 + x^2 + x + 1 = y^2.$$

275. Proposed by V. M. SPUNAR, Chicago, Illinois.

A square, side $2a$, is represented by the equation $x^n + y^n = a$ ($n = \infty$). Find a like formula for an equilateral triangle.

SOLUTIONS OF PROBLEMS.

ALGEBRA.

480. Proposed by FRANK IRWIN, University of California.

Solve the following equation

$$(x-1) - 2\left(1-\frac{1}{x}\right) - 3\left(1-\frac{1}{x}\right)\left(1-\frac{2}{x}\right) - 4\left(1-\frac{1}{x}\right)\left(1-\frac{2}{x}\right)\left(1-\frac{3}{x}\right) - \cdots - n\left(1-\frac{1}{x}\right)\left(1-\frac{2}{x}\right)\cdots\left(1-\frac{n-1}{x}\right) = 0.$$

Also the equation

$$(x-a_1) - a_2\left(1-\frac{a_1}{x}\right) - a_3\left(1-\frac{a_1}{x}\right)\left(1-\frac{a_2}{x}\right) - \cdots - a_n\left(1-\frac{a_1}{x}\right)\left(1-\frac{a_2}{x}\right)\cdots\left(1-\frac{a_{n-1}}{x}\right) = 0.$$

[Adapted from a formula of Tait's.]

Solution by A. M. Harding, University of Arkansas.

It is evident that

$$(x-1)(x-2) \equiv x(x-1) - 2(x-1)$$

and

$$(x-1)(x-2)(x-3) \equiv x^2(x-1) - 2x(x-1) - 3(x-1)(x-2).$$

Let us assume that

$$(x-1)(x-2)\cdots(x-n+1) \equiv x^{n-2}(x-1) - 2x^{n-3}(x-1) - 3x^{n-4}(x-1)(x-2) - \cdots - (n-1)(x-1)(x-2)(x-3)\cdots(x-n+2). \quad (1)$$

If we multiply both members of this equation by $x - n$ and rearrange the terms we obtain

$$(x-1)(x-2)\cdots(x-n+1)(x-n) \equiv x^{n-1}(x-1) - 2x^{n-2}(x-1) - 3(x-1)(x-2) - \cdots - n(x-1)(x-2)(x-3)\cdots(x-n+1).$$

Hence, equation (1) is true for every value of n.

After dividing both members of the last equation by x^{n-1}, we find

$$\left(1-\frac{1}{x}\right)\left(1-\frac{2}{x}\right)\left(1-\frac{3}{x}\right)\cdots\left(1-\frac{n}{x}\right) \equiv (x-1) - 2\left(1-\frac{1}{x}\right) - 3\left(1-\frac{1}{x}\right)\left(1-\frac{2}{x}\right) - \cdots - n\left(1-\frac{1}{x}\right)\left(1-\frac{2}{x}\right)\cdots\left(1-\frac{n-1}{x}\right).$$

Hence, the roots of the given equation are $x = 1, 2, 3, \cdots, n$.

By a method similar to the one used above, it may be shown that the roots of the second equation are $x = a_1, a_2, a_3, \cdots, a_n$.

Also solved by Horace Olson, V. M. Spunar, E. F. Canaday, and C. P. Sousley.